Bruneau Subbasin Assessment
and
Total Maximum Daily Loads
of the
§303(d) Water Bodies

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ACRONYMS AND GLOSSARY

The acronyms and glossary used in this document are summarized in the following list. The list is only inclusive for those terms used in this Subbasin Assessment.

TERM	***DEFINITION***
BAG	Basin Advisory Group
BRO	Boise Regional Office of Idaho Department of Environmental Quality
BURP	Beneficial Use Reconnaissance Project of IDEQ.
CFU	Colony forming Unit.
CMS	Cubic Meters per Second (m^3/s)
Ephemeral stream	A stream which functions as a drainage channel that is normally dry but carries water in response to storms or annual snowmelt. There is no IDAPA definition. The USBLM describes ephemeral streams as streams that flow for brief periods of time. Many ephemeral streams do not appear on USGS maps as solid blue lines like the perennial streams do.
GIS	Geographic Information System
HUC	Hydrologic Unit Code (USGS designation)
HUC 17050102	Bruneau River Subbasin
HUC 4th Field	subbasin hydrologic unit
HUC 5th Field	Watershed hydrologic unit (a sub component of 4th Field HUCs)
IDAPA	The Idaho Administrative Procedures Act. Rules promulgated by the state of Idaho are referenced by their IDAPA number.
IDL	Idaho Department of Lands
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
Intermittent stream	IDAPA §58.01.02.003.50 defines intermittent stream(s) as "a stream that has a period of zero flow for at least one week during most years. Where flow records are available, a stream with a 7Q2 (the lowest flow that occurs in seven consecutive days within a two year period) hydrologically based design flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with perennial pools, which create significant aquatic life uses, are not intermittent." USBLM describes intermittent streams as streams that have periodic interruptions in a normal pattern or process. USDAFS describes intermittent streams as streams in contact with the groundwater table that flow only

TERM	*DEFINITION*
	certain times of the year, such as when the groundwater table is high, or when they receive water from springs or from some surface source such as melting snow in mountainous areas. They cease to flow above the streambed when losses from evaporation or seepage exceed the available stream flow (USFS 1997d).
LA	Load allocation. The amount of a pollutant ascribed for nonpoint source industries in a TMDL
LC	Load Capacity. The amount of pollutants that a water body can assimilate and still support the beneficial uses.
Man-made water body	IDAPA §58.01.02.003.57 defines man-made waterways as "canals, flumes, ditches, and similar features, constructed for the purpose of water conveyance."
MOS	Margin of safety in a TMDL
Nonpoint source	Any unconfined and diffuse source of contamination, such as stormwater, snowmelt runoff, or atmospheric pollution. Legally, a nonpoint source of water pollution is any source of water pollution that does not meet the definition of "point source" in §502(14) of the Clean Water Act (USEPA 1997 [p. xii])
NRCS	Natural Resources Conservation Service
NPDES	National Pollution Discharge Elimination System Permit. Issued by USEPA for the state of Idaho.
Perennial stream	A stream that flows year-round in most years. There is no IDAPA definition. USBLM describes perennial streams as streams which have uninterrupted flow from year to year. USFS describes perennial streams as streams that flow continuously throughout the year (permanently) (USFS 1997d).
Point source	Any discernable, confined, or discrete conveyance (pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel, or other floating craft from which pollutants are or may be discharged (USEPA 1997).
QA/QC	Quality Assurance/Quality Control
SBA	Subbasin Assessment
SCC	Soil Conservation Commission
SCD	Soil Conservation District
TFRO	Twin Falls Regional Office of IDEQ
TMDL	Total maximum daily load. The standard formula for a TMDL is TMDL= Loading Capacity= Assimilative Capacity= Point Source Wasteloads+ Nonpoint Source Loads+ Margin of Safety.

TERM	*DEFINITION*
TP	Total Phosphorus
USBLM	United States Bureau of Land Management
USDA/ARS	United States Department of Agriculture/Agriculture Research Service
USEPA	United States Environmental Protection Agency
USDAFS	United States Department of Agriculture Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WLA	Wasteload allocations for point source facilities.
WAG	Watershed Advisory Group

1.0 EXECUTIVE SUMMARY OF THE BRUNEAU RIVER SUBBASIN ASSESSMENT AND TMDL DEVELOPMENT

The Clean Water Act established a process for restoring the nation's water bodies to health. Part of this was the designation of impacted waters by the states, through listing such waters as in §303(d). The 1996 §303(d) list for the state of Idaho (EPA 1996) included 16 segments occurring within the region designated as the Bruneau River Subbasin. Nine segments remain on the 1998 §303(d) list. The Bruneau River Subbasin Assessment and Total Maximum Daily Load (SBA-TMDL) for surface waters of the Hydrological Unit Code 17050102 describes those nine water bodies and 19 pollutants that are listed on the 1998 §303(d) list prepared by the state of Idaho. In addition, two additional pollutant water body combinations are included in the SBA-TMDL. The listed water bodies are considered "water quality limited" and may not meet their beneficial uses as defined by state of Idaho water quality standards. The SBA provides information pertaining to existing and designated beneficial uses. The information in the SBA includes those pollutants and the sources of pollutants that are affecting these beneficial uses. The information was obtained from a variety of sources including monitoring efforts of Idaho Department of Environmental Quality (IDEQ) and other agencies and individuals. The public has also been involved in the development of the SBA-TMDL through a variety of venues. Most notably, public meetings were held within the subbasin at various locations. Principally public meetings were held in the towns of Bruneau and Three Creek. The general physical and biological characteristics of the Bruneau River Subbasin have a strong influence on the water quality of the subbasin. Land use in the subbasin is predominantly rangeland. Limited irrigated agriculture also exists in the subbasin where water is either pumped from the ground or diverted from the river and tributaries. The major population center of the basin is the Bruneau-Grand View area.

The subbasin contains three different water sources. The first of these is seasonal runoff from the snowpack in the southern mountain region. The second is the thermal aquifer below Bruneau and Grand View, which is part of the Western Snake River Plain Aquifer. The final source is from precipitation events on the unintegrated ephemeral channels of the Bruneau subbasin plateau. These sources affect water quality to varying degrees. The geothermal water from the local thermal aquifer may affect water quality most significantly as the amount of water entering the streams and rivers of the subbasin from the other sources changes seasonally. Ephemeral surface channels can influence the water quality of the river and streams by adding a significant but rare and random pollutant load. However, this influence may only be seen during higher flow periods in the various waterbodies.

The subbasin land forms, vegetation, topography, and precipitation can be defined by two ecoregions. The predominant ecoregion of the subbasin is the Snake River Basin High Desert. The Snake River Basin High Desert ecoregion is predominantly sage-steppe grasslands. Most of the surface streams are intermittent or ephemeral in nature due to low annual precipitation and evaporation. Consequently, limited riparian habitat exists within the subbasin. Those streams that remain perennial usually form from spring sources in the southern mountains of the subbasin or from the thermal aquifer that underlies the town of Bruneau. Along these stream courses some riparian habitats persist.

Sediment is the most common listed pollutant in the subbasin. Sediment was a listed pollutant on all 1998 §303(d) listed waterbodies within the subbasin. Other listed pollutants and stressors include nutrients, low dissolved oxygen, flow, and bacteria. The SBA portion of the SBA-TMDL determines the current amount of a particular pollutant in each of the §303(d) listed water bodies' watersheds. The SBA also determines what impact to the beneficial uses each pollutant may have.

In general, the impacts to the beneficial uses were determined by assessing the biological communities and the limited water chemistry data available. When these two data sets were in agreement with one another, appropriate actions, such as completing a TMDL or delisting the stream, were undertaken.

In general, the water quality of the Bruneau River is very good. Furthermore, limited impacts have occurred in the upstream watersheds. As a result, water quality reflects this. Concentrations of suspended materials (as suspended

solids and sediment) are very low throughout the subbasin. However, on a seasonal basis the Bruneau River and other surface waterbodies exceed state water quality standards for a single or multiple pollutant such as excessive nutrients, temperature and/or other pollutants. The temperature exceedances may be due to the influence of the thermal spring waters. These waters form the principle habitat for the endangered species the Bruneau Hot Springsnail. However, in all cases of the §303 (d) listed water bodies, annual average concentrations of total suspended sediment are below 50 mg/L in the subbasin. Although in some cases suspended sediment concentrations did exceed the 80 mg/L daily maximum targets in some samples. However, due to the natural variability of the various systems and the limited samples available for analysis (one sample a month in most cases) limited weight should be given to individual samples. Therefore, IDEQ asserts that the annual average concentration is a more robust measure that reflects the overall conditions of a water body. Although, due to the averaging period constraints of the targets (monthly average and daily maximum) waters with exceedances of theses two averaging periods will be considered for TMDLs even though the annual average concentrations are low. By doing so seasonal components of water quality degradation and critical conditions are more fully addressed. In the case of suspended sediment, the concentration of 50 mg/L TSS monthly average and 80 mg/L daily maximum concentrations have been determined by the National Academy of Science and National Academy of Engineers to provide for protection of aquatic communities and by defacto acceptance by the state of Idaho and USEPA through several TMDLs. However, the bedload sediment (surface fines) in the Three Creek watershed is higher than that of a fully supported creek within the same area while suspended sediments are below the 50/80 mg/L targets. In the Three Creek watersheds surface fines averaged 54 percent, well above a comparison stream's average of 40 percent. As a result, the TMDL for the Three Creek Watershed will require a 44 percent reduction in surface fines (or bedload).

Nutrients are a listed pollutant in the Bruneau River and Jacks Creek segments of the Bruneau River Subbasin. In these reaches it was determined that total phosphorus (TP) can be a limiting nutrient, and that all nutrients may be in excess of USEPA Blue Book recommendations. Therefore, a reduction in TP would provide the greatest reduction in nuisance aquatic vegetation. Background TP concentrations at the beginning of the §303(d) listed segment of the Bruneau River were near 0.023 mg/L annual average; concentrations near the end of the reach annually averaged 0.083 mg/L. Only nonpoint sources and naturally soil-associated phosphorus contribute to this increase in TP concentration as there are no point sources located within the watershed. In the Jacks Creek watershed annual TP concentrations averaged 0.202 mg/L. The United States Environmental Protection Agency has set guidelines for TP concentrations in rivers flowing into lakes and reservoirs. As a result, the Bruneau River and Jacks Creek TP concentration target is set at 0.05 mg/L. A 37.5 percent reduction in TP will be required for nonpoint sources within the Bruneau River Watershed, and a 75.25 percent reduction will be required for point and nonpoint sources in the Jacks Creek watershed in order to meet these targets.

The other listed streams and pollutants in the subbasin, in general, were well below any standard or guideline established for the protection of beneficial uses or were dry for all of (or a majority of) the year. From information gathered for the SBA, it was determined that three of the listed waterbodies should not have been considered water bodies which would have supported beneficial uses and were therefore originally listed in error. For example, Sugar Creek had a U.S. Geological Survey peak flow gauge for ten years. During this period, eight of the ten years peak flow was zero cubic meters per second. The two other creeks (Cougar Creek and Poison Creek) were assessed by the Idaho Department of Fish and Game and the Idaho Department of Environmental Quality (IDEQ) under a Bull Trout Problem Assessment. In the assessment it was determined that the streams were ephemeral and likely did not ever support a fishery. IDEQ Beneficial Use Reconnaissance Project monitoring over the last five years corroborates the ephemeral nature of the streams. The IDEQ has determined, for these streams, that their original listing was in error due to their potential for recreational and aquatic life beneficial uses being nonexistent.

Flow and habitat alteration issues were not discussed in the SBA-TMDL due to current IDEQ policy. It is IDEQ policy that flow and habitat alteration are pollution and therefore not a "TMDLable" pollutants. These forms of pollution will remain on the §303(d) list; however, TMDLs will not be completed on segments listed with altered flow or habitat as a pollutant at this time.

Temperature, under the current standards, is a minor problem in some segments of the Bruneau River Subbasin. However, this is generally considered by the residents of the Bruneau area to be a natural problem. Additionally, in other areas of the state bioassessment data conflicts with concurrent temperature information and water quality standards. This is likely the result of the state's current water quality standards being derived from an outdated understanding of the cold water biota's temperature requirements. Consequently, IDEQ is participating in a regional review of temperature criteria, which is being organized by USEPA Region 10. Following the conclusion of the temperature review, temperature exceedances in the Bruneau River Subbasin will be reassessed and, if needed, a temperature TMDL will be completed.

The following tables summarize the TMDLs to be completed, delayed, or delisting actions as a result of the Bruneau River SBA-TMDL.

Table 1. TMDLS TO BE COMPLETED IN THE BRUNEAU RIVER SUBBASIN

Segment	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant
Bruneau River	Nutrients - TP			
Jacks Creek	Nutrients -TP	Dissolved Oxygen -TP	Bacteria	Sediment- TSS
Three Creek	Sediment - percent fines			
Clover Creek	Bacteria			
Sugar Valley Wash	Nutrients -TP	Dissolved Oxygen -TP	Bacteria	Sediment- TSS

Table 2. DELISTINGS IN THE BRUNEAU RIVER SUBBASIN

Segment	TMDL-pollutant	TMDL-pollutant
Bruneau River	Sediment	
Hot Creek	Sediment	Bacteria
Clover Creek	Sediment	
Cougar Creek	Sediment	
Poison Creek	Sediment	
Sugar Creek	Sediment	
Wickahoney Creek	Sediment	

Table 3. TMDLS DELAYED IN THE BRUNEAU RIVER SUBBASIN

Segment	TMDL-pollutant	TMDL-pollutant
CJ Strike- Bruneau Arm	Nutrients	Pesticides
Bruneau River	Flow Alteration	Temperature
Jacks Creek	Flow Alteration	Temperature
Wickahoney Creek	Flow Alteration	
Hot Creek	Flow Alteration	

2.0. INTRODUCTION

The Bruneau Subbasin Assessment and Total Maximum Daily Load (SBA-TMDL) describe those water bodies in Hydrologic Unit Code (HUC) 17050102 originally listed on the 1996 §303(d) list of the Clean Water Act. In this HUC, seventeen water bodies were listed in 1996. Two were segments of the Bruneau River. One is a section of the CJ Strike Reservoir known as the Bruneau arm. The remaining segments were tributaries to the Bruneau or Jarbidge Rivers. In the next iteration of the §303(d) listing cycle (1998), seven water bodies were removed from the 1996 §303(d) list. At that time it was determined that the seven water bodies met state standards and their beneficial uses were fully supported. Those water bodies included Mary's Creek, two segments of Sheep Creek, Big Flat Creek, Cherry Creek, Deadwood Creek, and one segment of the Bruneau River. These water bodies will not be covered by this SBA-TMDL. The 1998 delisting of these seven water body segments has been approved by the United State Environmental Protection Agency (USEPA). Upon finalization of this Bruneau River SBA-TMDL, some of the remaining segments will be removed from the §303(d) due to TMDL completion or other factors identified in the SBA-TMDL. Others will be delayed until a later date as described in the following sections of this document (see figure 1 for all 1998 listed water bodies). However, the Bruneau arm of CJ Strike will be incorporated into the upcoming CJ Strike Subbasin Assessment and TMDL due to USEPA in 2004. The assessment and data collection for the Bruneau arm of the reservoir was delayed to better utilize resources for the remainder of the subbasin and in future subbasins. By incorporating the reservoir section of the subbasin into the CJ Strike assessment, which is dominated by reservoir conditions, better data can be collected for the Bruneau arm. This improvement of data collection will arise due to IDEQ monitoring abilities and equipment requirements for a reservoir system being consolidated into one assessment and TMDL.

2.0.1 Identification System

Throughout this SBA-TMDL, the watershed delineation and numbering system (HUCs) developed by the United States Geological Survey (USGS) will be used. This system provides a standard method for describing subbasins and the watersheds within a particular subbasin. The Bruneau River Subbasin corresponds with the fourth field HUC of 17050102. Within this subbasin, 36 watersheds have been delineated as fifth field HUC. Further resolution of subwatersheds (sixth field HUCs) is possible within the HUC system but will not be used in this SBA-TMDL. Figure 2a shows HUC 17050102 in relationship with other surrounding HUCs. Figure 2b shows the Bruneau River Subbasin in relationship with the state of Idaho. Figure 3 shows the 36 watersheds found within the Bruneau River Subbasin. Load allocations will be based upon the land uses identified by Geographic Information System (GIS) in the fifth field HUC watersheds of the subbasin. However, if a stream makes up only a small portion of a watershed's hydrology, a river corridor approach will be taken to set load allocations.

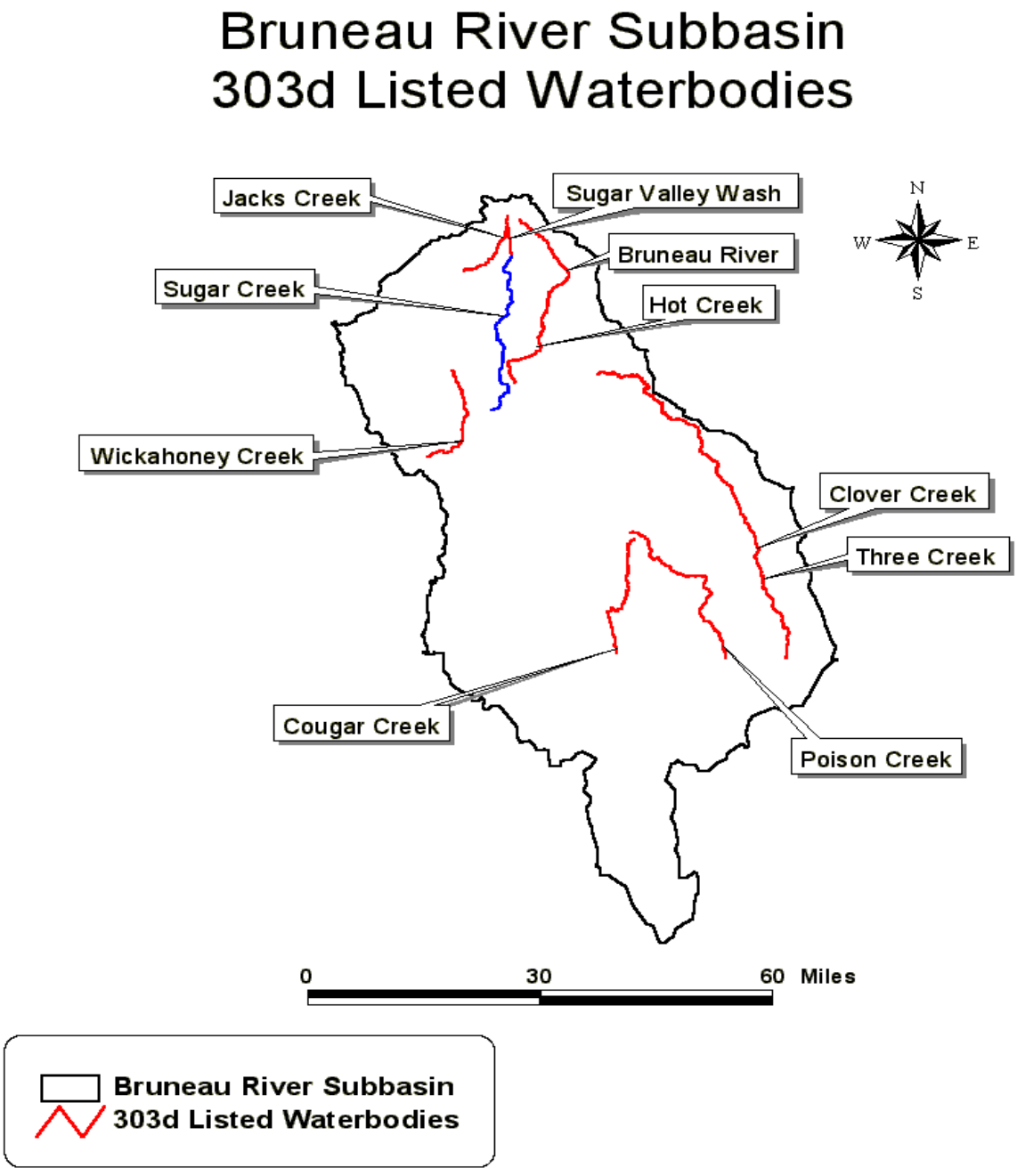

Figure 1. 1998 §303(d) Listed Water Body Locations

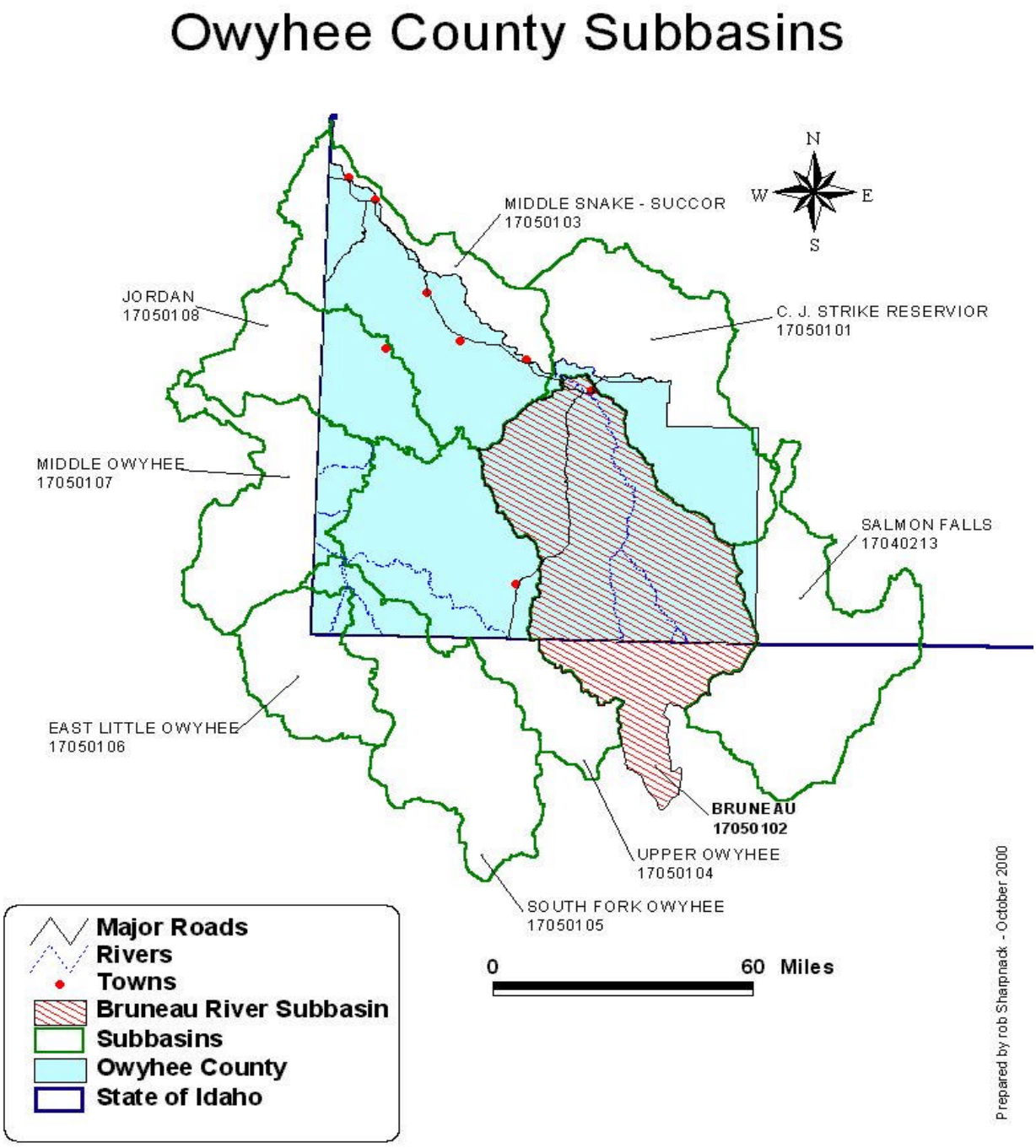

Figure 2a. Bruneau River Subbasin in Relationship with Surrounding subbasins.

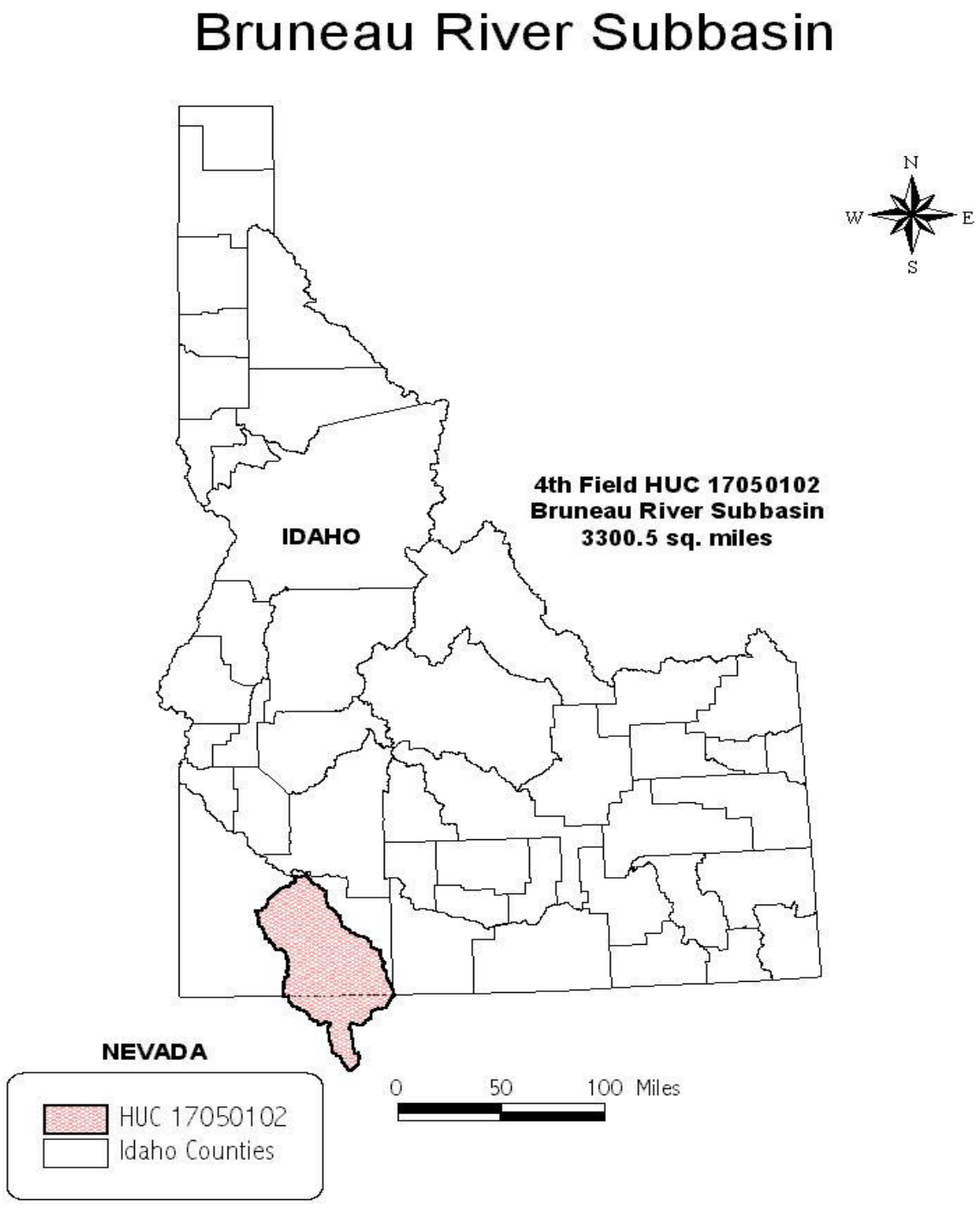

Figure 2b. Bruneau River Subbasin in Relationship with the State of Idaho.

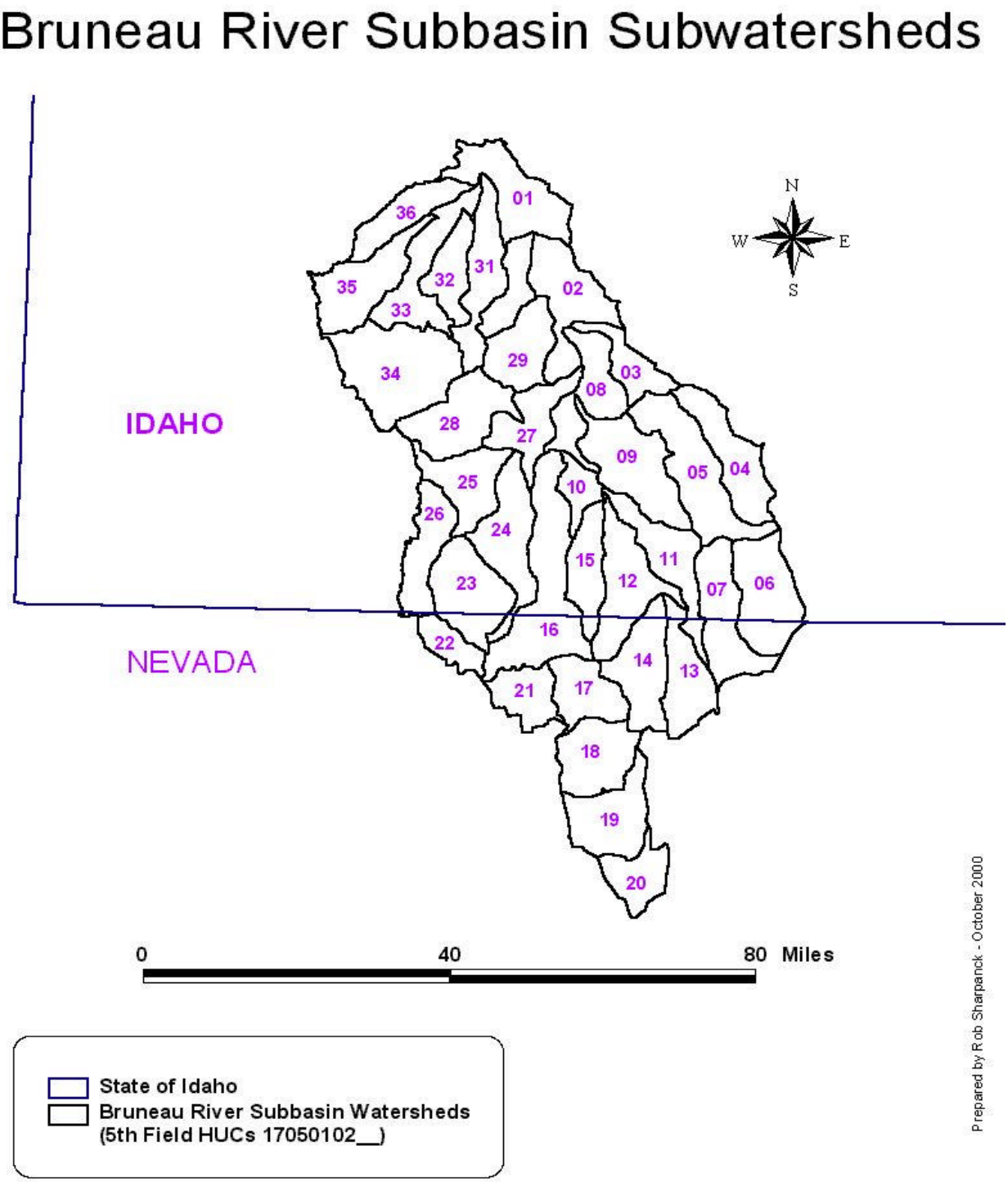

Figure 3. Bruneau River Subbasin Watersheds of Idaho and Nevada.

2.0.2 Compilation of Databases

The development of a SBA-TMDL requires a substantial amount of data collection from sources other than Idaho Department of Environmental Quality (IDEQ). However, data from other sources was very limited in the case of the Bruneau River SBA-TMDL. Those sources, besides IDEQ- Twin Falls Regional Office's (TFRO) ambient water quality monitoring, included USGS, U.S. Fish and Wildlife Service (USFWS), USEPA, U.S. Bureau of Land Management (USBLM), U.S. Department of Agriculture/Agricultural Research Service, Natural Resources Conservation Service, Idaho Department of Fish and Game (IDFG), Idaho Department of Lands (IDL), Idaho Department of Water Resources (IDWR), Idaho Soil Conservation Commission, Bruneau River Soil Conservation District (BR/SCD),and the IDEQ Beneficial Use Reconnaissance Project (BURP) .

The compilation and review of data from these sources focused primarily on assessing the beneficial uses of the rivers and tributaries within the subbasin. Assessments were completed if the rivers and streams had other data associated with them in addition to IDEQ BURP data. However, the focus was primarily on the 1998 §303 (d) listed streams and rivers. Other streams and rivers with no BURP data associated with them will also be addressed in this SBA-TMDL if water quality standards and or beneficial uses are not met. Load allocations and waste load allocations will be based on all available water chemistry data or appropriate surrogate measures. It is expected that where current technology-based controls are inadequate to achieve water quality standards, the implementation of a TMDL will provide more stringent water quality-based controls. The Bruneau River Subbasin TMDLs will be structured on wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin
of safety (MOS): where TMDL = WLA + LA + MOS. The MOS will account for scientific uncertainty in the TMDL due to insufficient or poor quality data, lack of understanding in receiving waters assimilative capacity, and the lack of understanding of the effects of pollutant loading rates on the load capacity of receiving waters. The MOS, most often, will be implicit due to a conservative approach taken in determination of load capacity, point and nonpoint source loads, and conservation of pollutants in modeling.

2.0.3 Public Involvement

As envisaged in Idaho's 39-3601 et seq. legislation and Idaho's TMDL process, Watershed Advisory Groups (WAGs) are to be used to encourage public participation. Public involvement for the Bruneau River Subbasin has taken place concurrently with the development of the TMDL. The Basin Advisory Group (BAG) will also provide input into the Bruneau River SBA-TMDL until a functional WAG can be developed.

The Southwest Basin Advisory Group (BAG) provides guidance and advice to IDEQ in the final development of SBAs and TMDLs in the Southwest Basin. Part of this assistance consists of review of the document after formal presentation and providing comments and assistance. The SBA-TMDL was presented to this group on November 2, 2000.

Following public announcements, meetings were held in the Bruneau subbasin to relay progress of the SBA and TMDL process. The first of these meeting was held in the city of Bruneau in February 1999. The Bruneau River area group has not undergone any formal recognition by the BAG and has not undertaken any formal organization into a Watershed Advisory Group (WAG). The group has preferred to stay informal and to use the Soil Conservation District (SCD) as a platform for organization. The group has also decided to provide comments on the progress of the SBA-TMDL through the SCD. Additionally, interested residents from the Three Creek area have met with IDEQ and have been presented information regarding progress and status of the SBA-TMDL.

Local conservation districts began organizing in Idaho in 1940, and are legal subdivisions of state government whose volunteer district supervisors are locally elected. The district supervisors have encouraged participation from their constituents in the Bruneau River SBA-TMDL activities. A single district is within the area of the SBA.

Organized in 1953, the Bruneau River SCD covers approximately 3,000,000 acres in eastern Owyhee County. The main goal of the SCD at that time was to assist each operator in the district with the development of a soil and water conservation plan for his or her operations. The SCD currently has placed irrigation water management, rangeland management, animal waste management, and protection of wildlife habitat as high priorities in its long-range resources conservation program (McBride 2000).

2.1 Characterization of the Watershed

The characterization of the Bruneau River Subbasin will be based on its physical and biological features and how they interplay with the ecoregional and hydrological traits. The Bruneau River Subbasin is complex in its characterization, principally due to a dichotomy of land types within the Idaho portion of the subbasin. The dry, open, and highly accessible plateaus are contrasted by the confined and relatively inaccessible canyons through which the majority of water in the subbasin flows. Additionally, the source for much of the water in the subbasin comes from snowpack and rainfall in the mountain ranges in Nevada to the south. An additional portion of the subbasin complexity is the issue of nonpoint source pollution within the waterbodies, which is affected by soil characteristics, climate, vegetation, topography, and human activities.

2.1.1 Subbasin General Characteristics

As defined by the fourth field HUC system, the Bruneau River Subbasin covers about 8546.96 km^2 in southwestern Idaho and northeastern Nevada and encompasses several water sources.

1. The springs, snowpack, and rainfall in the Jarbidge Mountains and Jarbidge Wilderness area are the major water sources for the Jarbidge river system. The headwaters to the Jarbidge River begin between Fox Creek Peak and Cougar Peak at approximately 2,900 m elevation. While the headwaters of the East Fork of the Jarbidge River begin near Slide Rock Ridge to the north of Mary's River Peak at an elevation of 3,220 m. Both the Jarbidge River and the East Fork of the Jarbidge River enter Idaho at an elevation of approximately 1,640 m.

2. The Bruneau River system begins in a high desert basin bounded by Coyote Mountain (2,201 m elevation) to the east, Mason Mountain (2,277 m) to the west, and Lookout Mountain (2,085 m) to the south. It is formed by springs, snowpack, and rainfall in this area as well as from the Copper Mountains to the east and The Mahoganies to the west. The Bruneau River enters Idaho at an elevation of approximately 1,480 m.

3. Desert tributaries, in general, are the final source of water to the Bruneau River Subbasin. Most of the tributaries are formed on the plateaus and drop steeply in their final few kilometers before their confluence with the major rivers. For example, Deadwood Creek drops over 80 m in the final 3.62 km before it joins the East Fork of the Bruneau River (Clover Creek). Others, such as Mary's Creek drop 160 m in 3.22 km prior to joining Sheep Creek. The majority of these desert tributaries are ephemeral. In the lower elevations of the subbasin, numerous hot springs emerge (Figure 4).

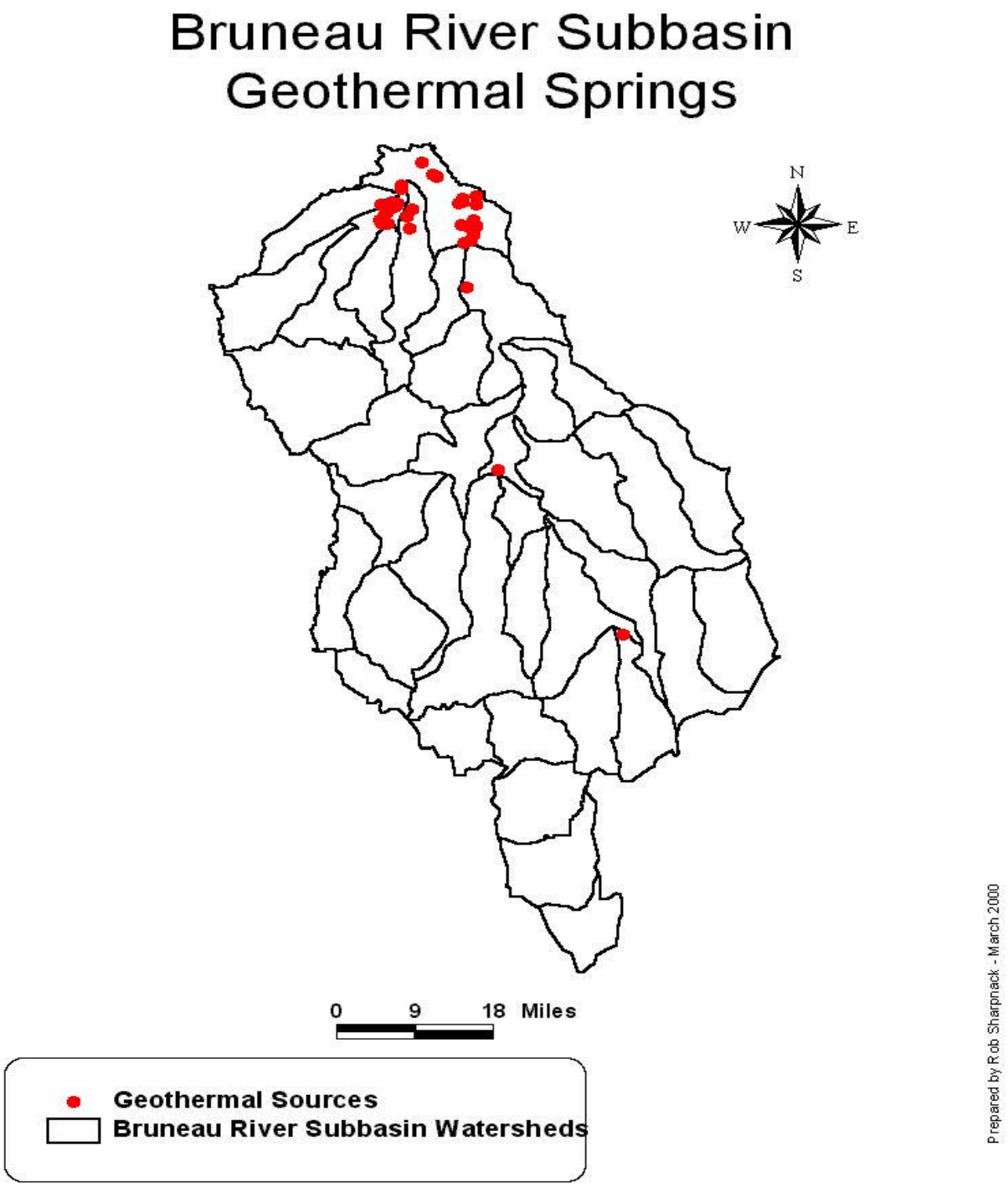

Figure 4. Geothermal Springs of the Bruneau River Subbasin.

Limited hydrologic modifications of the tributaries and of the mainstem rivers has occurred over the past several decades. These modifications include irrigation withdrawals and temporary storage structures designed to capture storm event runoff. This is most prominent in the tributary streams originating on the open plateaus. Many streams and tributaries in these areas contribute very little perennial surface flow to the mainstem rivers in this subbasin. However, intermittent and ephemeral channels proliferate in the area and impact the water quantity and quality of the mainstem rivers to an unknown extent. In addition, some losses of groundwater recharge via headcutting and the resulting loss of bank storage capabilities may have occurred in some of the perennial streams.

For these reasons, the application of the Clean Water Act in the Bruneau River Watershed is a matter of assessing the condition of the perennial stream and river systems. The conditions would be assessed under differing seasonally-influenced hydrological regimes to determine the critical periods for a river. The ephemeral and intermittent tributary creeks would then be assessed as separate entities. A final step would be to determine the effects the various thermal groundwater sources have on the rivers and streams.

2.1.1.1 Watershed Morphometry

The region is cartographically covered by 1:24,000-scale and higher USGS topographic quadrangle maps. The total vertical relief in the area is 2,583 m, from an elevation of 720 m at CJ Strike Dam to 3,303 m in the Jarbidge Mountains (Matterhorn Peak). Locally, slopes on the plateaus are usually quite gentle (although overall relief to the canyons is considerable), with considerably steeper slopes in the mountains.

The topography is chiefly an expression of the geologic structure and historical entrenchment processes. The faulted, linear mountain chains of the Basin and Range ecoregion border the Snake River Basin Plain to the south. The subbasin slopes from the south to the Snake River, which forms the northern border. The plateau areas of the subbasin generally are expanses of unintegrated depressions, low volcanic plateaus, and rough, irregular basalt flows. As stated previously; however, the area contains many intermittent and ephemeral stream systems.

The Snake River borders the subbasin on the north and has entrenched to varying depths. The Bruneau and Jarbidge rivers bisect the subbasin and flow through entrenched gorges of various depths. Small alluvial terraces rise above the rivers in limited locations. These; however, are restricted to open areas within the canyons due to the confinement of the river system within the entrenched canyons.

As stated previously the Bruneau River Subbasin covers approximately 8,546.96 km^2 in total area. Nearly 6,475 km^2, or 76 percent of the subbasin, is within the state of Idaho. The elevation range within the Idaho portion of the subbasin is from 800 to 2,300 m. The average elevation of the entire subbasin is approximately 1,470-1,770 m. The entire subbasin slope range is from less than 1 percent to 46 percent. Average subbasin slope is approximately 4 to 7 percent. Generally, the plateaus have slopes of less than 5 percent, while the river canyons and the area of the subbasin in Nevada have slopes greater than 5 percent. Overall, the subbasin has a northwest aspect. The stream channels and mainstem rivers follow a dendritic drainage pattern throughout the subbasin. In the subbasin, there are 1586.81 km of perennial streams; 4,842.52 km of ephemeral and intermittent streams; and 75.64 km of canals and ditches (Table 4). Roughly 51 percent of the perennial streams are located below 1828 meter elevation, which corresponds with the area of the subbasin located within Idaho. Approximately 83 percent of the intermittent and ephemeral streams are located in this same area.